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Camp Lejeune TCE Findings May Prompt New Drinking Water Policies

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Authors of a federal epidemiological study say they found links between exposure to contaminated drinking water, particularly trichloroethylene (TCE), and birth defects at a Marine Corps base and that the findings may be used to guide future regulations on drinking water contaminants, but one outside risk assessor is disputing that the study actually shows such a link to TCE.

The study, by the federal Agency for Toxic Substances & Disease Registry (ATSDR), could add to the debate over TCE's non-cancer risks, which already include a dispute over the inhalation risks of the solvent.

EPA's inhalation risk level -- which is partially based on a controversial toxicological study that links short-term TCE exposure to cardiac birth defects -- has been disputed since EPA published the value in 2011. States and others have struggled with how to translate the value on acute exposure into risk management decisions at site cleanups and with critics calling for a re-analysis of the risk number and its reliance on the heart defects study.

One environmentalist says it may be a while before EPA's risk program re-evaluates TCE, but the ATSDR study "reinforces the need to protect against short-term exposures to TCE, because of the risk to women who might be pregnant." The source, however, was uncertain how the findings may apply to inhalation risks.

Earlier this month, ATSDR released findings from a study on exposure to drinking water contaminated by volatile organic compounds (VOCs) at Marine Corps Base Camp Lejeune, NC, examining incidences of birth defects or oral clefts due to maternal exposures or childhood cancers due to exposures in-utero or during the first year of life. The study examined data from parents of 12,598 children living on base who were born between 1968 and 1985.

While the authors acknowledge the limits of the study -- that "the findings were based on small numbers of cases which resulted in low precision (wide confidence intervals)" for the odds ratios -- they nonetheless conclude that the results "add to the scientific literature on the health effects of exposures to these chemicals in drinking water."

They add, "Additionally, results of this study may be used in conjunction with results from other studies to guide future policy decisions such as regulating levels of these contaminants in drinking water." Further studies may be warranted in other populations to assess the link between VOCs and these outcomes, they say.

But the risk assessor discounts the study's TCE conclusions, arguing they are the result of data mining and random variation, and therefore should not be a trigger for additional studies into TCE exposure.

Water Contamination

The federal government has long been under pressure from lawmakers, veterans and others to further study the decades-long contamination of drinking water at Camp Lejeune. The historic drinking water contamination at the base may have exposed up to 1 million people living or working at the base to contaminated drinking water over a period of decades. Contamination of the water system at the base, which is a Superfund site, resulted from leaking underground storage tanks, industrial area spills and waste disposal sites.

The retroactive epidemiological study used extensive water modeling to reconstruct exposures, and was unique in its use of water modeling to thoroughly look at associations between monthly exposures to VOCs in drinking water at residences and the risk of developing a particular birth defect or childhood cancer, an ATSDR fact sheet says of the study. "Most previous studies

that have evaluated these associations have done so at the broad water system level versus drinking water at the residence," it says.

The study had a 76 percent participation rate, and while participants reported 106 cases of cancers, neural tube defects and oral clefts, the agency was only able to confirm a portion of these: 13 cancers, 15 neural tube defects (NTDs) and 24 oral clefts.

ATSDR says the study found associations between TCE and benzene exposures from Camp Lejeune drinking water and NTDs. "During the first trimester of pregnancy, the risk of a NTD increased with increasing levels of exposure to TCE," the fact sheet says, noting the finding is consistent with similar findings from a New Jersey study.

Specifically, it found a nearly two and a half times greater incidence of NTDs in those where exposure was greater than 5 parts per billion (ppb) of TCE in drinking water, with a 95 percent confidence interval of 0.6 to 9.6, seeing "a monotonic exposure response relationship for exposures categorized using the" maximum contaminant level (MCL), or federal drinking water standard, the study says, referring to an increase in incidences above the MCL as compared to below it. The MCL for TCE is 5 ppb.

For benzene, the researchers also saw an association between NTDs and first trimester exposure to the chemical, but were unable to determine if higher levels of exposure were linked to increased risk of NTDs because of the small number of exposure cases, the fact sheet says. The researchers identified six cases out of 73 people exposed, four times what would be expected on average, but with a 95 percent confidence interval of 1.4 to 12.0 percent.

For cancer, the study results "suggested weaker associations between [first] trimester exposure to [tetrachloroethylene (PCE)], vinyl chloride, and [1,2-dichloroethylene (DCE)] and childhood hematopoietic cancers such as leukemia" than those found for NTDs, the fact sheet says. It found a one-and-a-half times greater incidence of hematopoietic cancers in those exposed to PCE, vinyl chloride and DCE at lower levels in the first trimester.

But at higher levels of exposure to these chemicals, the researchers did not see an increase in these cancers, according to ATSDR.

And the researchers found no association between exposures to the drinking water contaminants and the risk of oral clefts.

Statistical Association

But the risk assessor disagrees that the study shows a statistical association between TCE and NTDs, adding the conclusion regarding TCE is reflective of "data mining." Specifically, the source cites the wide confidence intervals, and points to additional data found in the authors' report. The report has been peer-reviewed and is being published in the journal *Environmental Health*.

In the report's table on NTDs and VOC exposures, the source points out, the findings on TCE indicate a slightly lower incidence of NTDs from those exposed to TCE above 2 ppb than those exposed to levels below 2 ppb. But the data on those exposed to levels of TCE above 5 ppb compared to those exposed to levels below 5 ppb indicate an increase in NTD incidences. Using the 2 ppb cutoff, unlike the 5 ppb cutoff, the odds ratios are not increasing, according to the source. There is no statistical association between TCE and NTDs, the source concludes, noting that although the odds ratio did increase slightly when using the 5 ppb cutoff, it went slightly in the opposite direction when using the 2 ppb cutoff.

Further, the confidence interval -- the determination that 95 percent of the time the number of incidents will be within the interval -- includes the value expected to occur among controls, the source says. The source argues "this is just random variation," and should not be the trigger for further studies into TCE exposures.

At the same time, the source says the study cannot be used to support the negative -- for instance any suggestions that TCE is not linked to heart malformations. "You can't use this study to prove the negative," the source says, noting that some people nonetheless may try to do so.

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